

MARINE SHELLS OF MADRAS.

BY

M. D. CRICHTON.

(*With 4 plates*).

Melvill and Standen¹ computed the total of Madras marine mollusca at slightly over 700 of which, approximately, 470 were univalves and 230 bivalves. It should be noted, however, that the collections examined by them when compiling their catalogue included specimens from the neighbourhood of Pamban, a distance of 235 miles by sea from Madras, where coral formation predominates in marked contrast to the unrelieved sand of the southern portion of the East Coast of India. As there are many mollusca peculiar to coral-reef conditions which are not found elsewhere there would appear to be reason—if only as a matter of local interest—for keeping separate a record of species which are known to make their homes, in some cases it may be only as temporary visitors, within sound of the surf of the Coromandel Coast.

I have had opportunities of collecting at many places along the shores of this coast besides dredging down to 6 or 8 fathoms off Pondicherry, Cuddalore, Porto Novo, and Negapatam, and to a greater depth at Madras, and am satisfied that the forms found at Madras may be regarded as typical of the entire coast, say from Point Calimere (Lat. 10° 18' N.) to Cocanada (Lat. 17° N.). The territory covered by these notes, however, will be confined to the strip of sea-board in the immediate vicinity of Madras, extending about thirty miles from Ennur towards Covelong in the south. Apart from the harbour area the coast presents an unbroken vista of yellow sand except where intersected by the channels of the backwater at Ennur and of the Cooum and Adyar, two small rivers whose egress is barred periodically by great banks of sand piled up during the dry months following each north-east monsoon.

Consequently the mollusca comprise chiefly the dwellers in sand and mud, the only rock habitations being those provided by the hand of man, such as the blocks of concrete and stone placed as breakwaters for the protection of the harbour walls and the revetment immediately north of Royapuram Bay. The total number of species known to Madras exceeds 700, approximately 500 univalves and 230 bivalves. This total is constantly being added to. The mollusca here enumerated should be taken merely as a general indication of some of the species to be found.

THE LITTORAL ZONE.

The number of living mollusca within reach of the seeker along the shore is limited, not only by the absence of such favourite molluscan haunts as reefs and rock-fringed pools but also by the

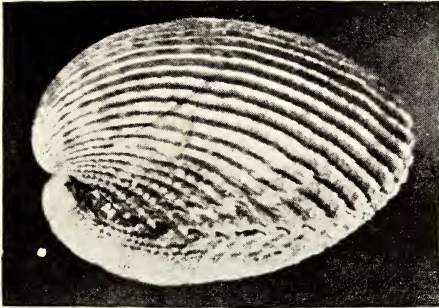
¹ The marine mollusca of Madras and the immediate neighbourhood. *J. Conchal.*, vol. 9, pp. 30-85 (1898).

restricted collecting area available between high and low water mark, the average rise and fall of the tide being under 3 feet with a maximum of 4.5 feet. Even so, a diligent search within wading depth will bring to light a fair range of species varying more or less regularly in seasonal rotation throughout the year. The most noticeable of these visitors is the lively tapering *Bullia vittata* (L.) with large water-charged foot and narrow and inadequate operculum which, with the rarer *B. livida* Reeve, may be seen in considerable numbers on the firm wet sand at low tide, particularly at Parry's Beach to the south of the harbour. This, on occasion, feeds on the little round-backed crab (*Philyra*) whose arrival synchronizes with that of *Bullia*; after an initial 'hand off', the crab submits to being seized without any further effort at resistance and is soon drawn within the muscular folds of the mantle. So determined is the hold on its victim that the *Bullia* can be pulled almost completely out of the shell without losing its grip. This mollusc dwells with us for several months each year, during which time its family increases and grows up rapidly. The shell of *B. livida*, although resembling that of *B. vittata* both in shape and design, except that the spiral band of tubercles below the sutures of the latter consists of two or three rows whereas in *B. livida* it is usually single, will be easily recognized by a richer colouring and thickened outer lip, in addition to which the operculum is squarely oval and more or less fills the aperture. *B. tranquebarica* (Röding) is a third local representative of this genus of the family *Nassariidae*, and its triangulate operculum with serrated edge completes the three types of operculum associated with this family.

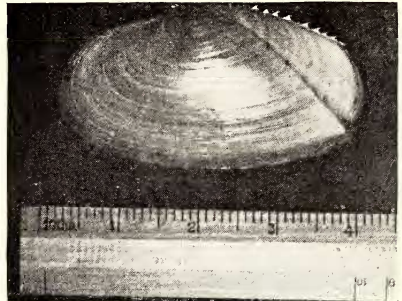
Farther south, at St. Thomé and beyond, olive-shells are to be found at all seasons, both *Oliva oliva* (L.) and *O. ispidula* (L.), the latter in an infinite variety of colours and markings. Early in February each year large colonies of *Oliva gibbosa* (Born), in mature form, are to be found for a brief season near the shore at Elliot's Beach, the raised ridges of their mole-like burrows in the sand indicating their position. This handsome shell attains a length of some 3 inches and bears a close resemblance to *O. nebulosa* Lam., both in pattern and colouring. The latter, however, is narrower with a more tapering spire. Unlike *O. gibbosa* it is very rarely taken near the shore although commonly dredged in from 6 to 10 fathoms in all stages of growth.

The Olives are also carnivorous and show a partiality for the shy little mole-crab (*Hippa asiatica* Edwards). I have more than once witnessed the unequal contest with the victim struggling valiantly but helpless in the pincers-like grip of *O. hispidula*, whilst the swift incoming waves have swept the pair several times up and along and down the gently sloping beach and finally into deeper water without being able to break them apart. One cannot help feeling a sympathy for this strange, gentle creature, known locally as 'eel-lee', which spends the entire day digging itself into the wet sand with feverish haste as each receding wave leaves the ill-protected little body exposed to the pounce of Brahminy Kites and crows ever on the look-out for the tasty morsel. Providence's only compensation would appear to be the allotment of a

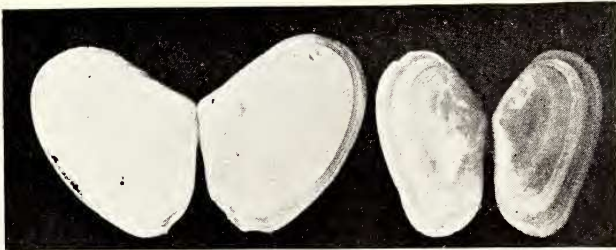
MARINE SHELLS OF MADRAS.



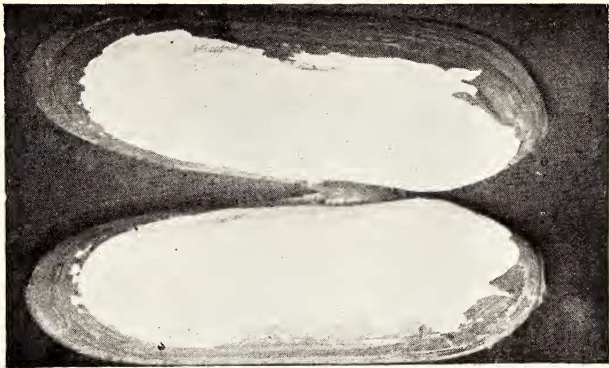
1. *Cardium assimile* Reeve.



2. *Tellina foliacea* Lin.



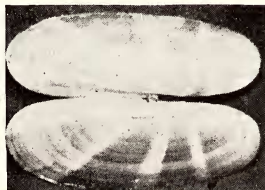
3. *Tellina angulata* Gmelin. *Tellina timorensis* Lam.



4. *Cuttellus maximus* (Gmelin).

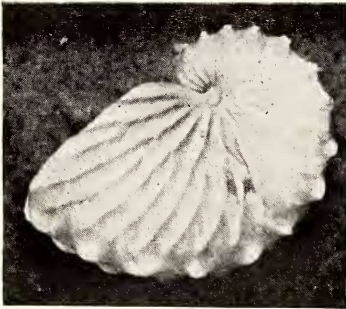


5. *Psammobia amethystus* Wood.

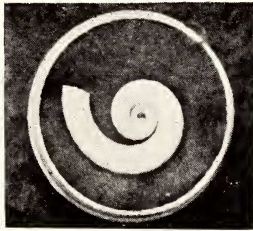


6. *Siliqua radiata* (Lin.).

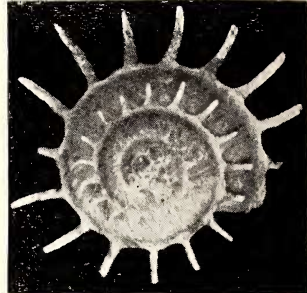
MARINE SHELLS OF MADRAS.



1. *Argonauta hians* (Solander).



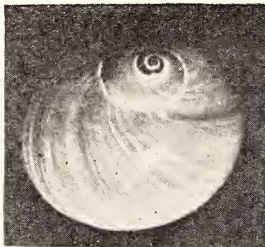
2. *Spirula spirula* (Lin.).



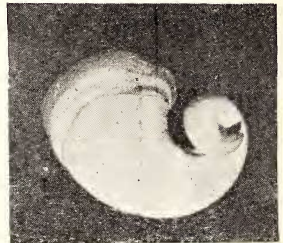
3. *Xenophora solaris* (Lin.).



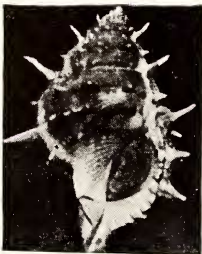
4. *Natica lineata* (Rod.).



5. *N. didyma* (Rod.).
(normal shell).



6. *N. didyma* (Rod.).
var. with scalariform
whorls.



7. *Bursa spinosa* (Lam.).



8. *B. crumena* (Lam.).



9. *Gyryneum natator* (Bolten).

very brief span and its troubles, therefore, are soon over. Let us hope that under cover of darkness there may exist compensations of a more material kind!

Rapana bulbosa (Dillwyn) (Plate III, fig. 6) is sometimes swept shorewards during stormy weather and may be found clinging to an old shell or root of sea-weed, the young ones adhering to each other in clusters. *Nassarius* and *Natica* (Plate II, figs. 4, 5, 6) may also be taken.

Amongst the bivalves which feed near the shore are found four or five kinds of wedge-shell, the finest being the magnificent *Douax scortum* L., strongly fashioned with deep corrugations and rich purple interior. The tiny *D. dussumieri* Bertin may be found during brief periods about February and August each year. Large quantities of this brilliantly variegated little shell congregate an inch or so under the surface at ebb of tide; when exposed they quickly dive out of sight, sharp end first, into the wet sand. The commonest is *D. cuneatus* L. in a range of colouring, radiating from the umboes, which includes pale blue, yellow, brown, and a harsh liver-green. The young are in evidence in October in the shelter of Ennur backwater, while in February and March the half-grown and adult shells may be found together in large numbers between tide marks at St. Thomé and Ennur. In calm water the circular orifice of the upper or lower siphon may be observed just above the surface of the sand, indicating the presence of the shell buried an inch or so below. Fully grown shells measure from 40 to 43 mm. in length. Other all-the-year-round frequenters of the intertidal region include *Sunetta scripta* (L.), beautifully and variously patterned in purples, browns, mauves, gold, and ivory. These make their début about December and their growth may be followed month after month until the following autumn when they attain a full stature of some 33 mm. Several other brightly patterned species of the Venus family are also found.

Macra cygnus Gm., whose thin but strongly formed shells, in a good range of colours, are usually to be found scattered on the beach, visits the shallows for a brief period only during the south-west monsoon, the young shells beginning to appear about April. *Macra mera* Rv., *M. striatula* L., and young *M. turgida* Gm. are not uncommon towards the end of the north-east monsoon. The shells are seldom found complete, i.e. with both valves joined together or 'mudi' (முடி) as our young helpers concisely describe this desirable condition, unless taken alive.

Of the Garidæ, *Soletellina diphos* (L.) should be looked for immediately south of the Adyar during the first violent storms of the north-east monsoon when it is dislodged from its sandy bed and flung ashore. Unless freshly collected the valves soon become separated, the thick greenish yellow periostracum cracks and peels away and the hot sun quickly bleaches the rich purple colouring of the shell. The young may be found earlier in the year in the extensive backwaters at Ennur and Covelong which are periodically open to the inflow of the sea.

The fan-oyster (*Pinna*) is another dweller in or near the channel of the Adyar river to seaward; live specimens are sometimes

uprooted from their burrows during the north-east gales. *Pinna* grows to a large size, *P. pectinata* L. (= *hanleyi* Rv.) and *P. attenuata* Rv. having both been found at Madras up to over one foot in length. A specimen of the latter, taken at Tuticorin, measures $19\frac{1}{2}$ inches. A third species, *P. vexillum* Born, of dark colour and spreading shape and provided with a short, strong byssus, is occasionally delivered up during stormy weather a few miles farther south; mature shells of this species are of heavy, stout structure and are easily recognized. It may be remarked that the Madras *P. pectinata* does not, as a rule, show any external sign of the byssus, usually associated with *Pinna*, although, on close examination, two or three fine silken threads will be found issuing from the byssal opening immediately above the foot of the animal. It seems possible that these particular individuals, living in sand, without stones or other suitable anchorage available, had no use for a byssus. *Pinna* breeds about May or June to judge by a 20 mm. juvenile collected towards the end of June. *Siliqua radiata*, the sunset-shell, is very seldom taken alive or even with periostracum, but the spread-out empty valves, brilliantly rayed with blue and white, are abundant on the wet sands at ebb-tide.

Towards the end of the year, after a period of gales, large numbers of living *Pecten tranquebaricus* Gm. and *Pinctada chemnitzii* (Phil.) are sometimes washed ashore at Ennur.

SHORE COLLECTING.

High-water mark throughout the year will reward the diligent seeker with a varying and fascinating harvest, chiefly of the smaller sort. There are many sharp little eyes at our service among the children of certain villages by the sea who have learnt to know what the *changu-dorai* wants and what he does not want. Amongst such helpers I remember with special gratitude Chinápen, Pichikaren, Sammykins and his sister Chinnapoo. From these high-tide gatherings could be named upwards of one hundred species, but a selection must suffice.

The gastropod Aglossates are well represented. Of these the brilliant *Pyramidella terebellum* (Müller), with deep-chestnut spiral bands, grows to a full inch. The genus *Turbovulla*, of the same family, is represented by five or six species, including the white *T. coromandelica* (Mclv. & St.), growing to 21 mm. With the aid of a magnifying glass may be clearly seen the peculiar development of the shell, the spiral growth of which begins in a sinistral direction thereafter twisting at right angles and finally developing in a normal dextral manner. The allied family of Eulimidae is represented by polished shells of the genera *Eulima*, *Balcis*, and *Niso*. The last is represented by two species, one of which, *Niso pyramidelloides* Nevill, just over half an inch in height and recognizable by its double spiral band of rich chestnut-brown, is among Madras's loveliest shells. *Balcis* is of snow-white colour, a typical feature of many species being a graceful backward bend which is very noticeable in *B. martinii* (A. Ad.). *Eulima* is usually spirally banded with brown; the local species *E. bivittata* (H. & A.

Ad.) grows to about $\frac{3}{4}$ in. in height. Some Eulimids are parasitic on 'sea-cucumbers' to which they attach themselves so firmly that considerable force is required to dislodge them. These shells are washed up during the south-west currents between March and August each year.

Another attractive genus is the familiar wentletrap or *Epitonium*, of which a dozen or more species may be gathered during the same season; also two species of the little *Ringicula*, and the iridescent *Minolia impressa* (Nevill). These last three, and other small fry such as *Bullina*, *Pupa*, *Cylichna*, should be sought for amongst the scum and weeds of high-water mark on the seaward bend of the estuary at Ennur as well as in deep cracks in the water-sodden timbers of old catamarans.

The Scaphopoda are represented at Madras by two species of *Cadulus* and by six or seven of the well-known *Dentalium* or elephant's tusk-shell. Beach specimens of the latter are usually broken and should not be collected unless the posterior or smaller end is intact, the margin of the small opening being often notched on the convex side. In addition, several species are furnished with a small supplemental tube protruding from the apical end, easily broken. Besides the smooth forms, *D. octangulatum* Don. may be found with seven, eight, and nine main ribs. A six-ribbed shell of stout *octangulatum* form and one of 16 ribs, have still to be identified.

The Class Cephalopoda comprises creatures of the type of squid, octopus, etc., in which the shell is internal or absent. The calcareous 'cuttlefish bones' which litter our beaches at all times belong to *Sepia* and *Sepiella*. *Sepia prashadi* Winckworth whose pink-backed shells, up to 110 mm. in length, are to be found from January to early in April each year, has only recently been described. *Sepia andreanoides* Hoyle (*Doratosepion*) also occurs, measuring $2\frac{1}{4}$ inches, of similar colouring towards the spine but narrower in shape and with the dorsal longitudinal depressions undeveloped; rare here, it is common on Khor Maksar beach at Aden. *Loligo* is very common; a live individual must be secured in order to obtain a specimen of its transparent and perishable 'pen'.

The shells of the three external shell-bearing Cephalopods are also to be found at Madras. Those of the deep-sea *Spirula spirula* (L.) (Plate II, fig. 2) and of *Nautilus pompilius* L. are thrown up in stormy weather, the latter always in fragmentary condition. I once picked up a young *Nautilus* shell measuring 1 inch in length about eight miles south of Elliot's Beach and I have also found one *Argonauta hians* Sol. (Plate II, fig. 1) in what appears to be fresh condition. This indication of the presence of a Nautilid nursery off the Coromandel Coast must not be accepted too readily as these shells are very buoyant and may be brought to our shores from other parts by monsoonal currents.

The arrival of large numbers of the seed pods of *Carapa obovata*, also stated to be *C. moluccensis*, during the early months of each year when north-easterly winds have already been blowing for two or three months, may be cited as an instance of the carrying power of the winds and sea currents. The *Carapa* tree grows

in the tidal forests and mangrove swamps of Malaya, on the Aracan Coast of Upper Burma and, doubtless, in the Nicobars and Andamans and it seems likely that some of the pods which reach Madras may have come from the last-named place which is a known habitat of *Nautilus*. The nearest location of Carapa to Madras is fully 200 miles to the north, in the Guntur forest division, so that in any case the pods in question must have travelled by sea for a considerable distance.

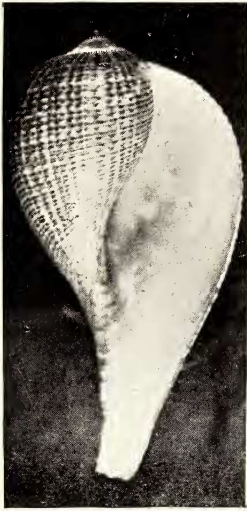
The Carapa pods should be examined as they frequently harbour a nest of ship-worms (*Teredo*) which, as free-swimming fry, have attached themselves to the floating homes so conveniently offered and dug themselves in to such good purpose that during the long sea voyage they have developed and grown to full capacity, supplanting the kernel and filling the entire shell with a closely packed twist of their strange tubular casings. Inside these tubes will be found the palettes and shells of *Teredo clava* Gm. Similarly, waterlogged branches or pieces of timber often house *Martesia* and should not be passed by unchallenged.

Amongst the less common lamellibranchs should be recorded the watering-pot shell (*Brechites*), with aberrant valves which fail to function in a normal manner at an early age, the unhappy inhabitant thus being left to 'think again'. The result is an amazing travesty consisting of a cylindrical tube, 4 or 5 inches long, terminating at the lower extremity in a perforated convex shield surrounded by a frilled border of tubes branching out like the petals of a flower, the perforated centre being reminiscent of the rose of a watering-pot. An examination of the tube, immediately above the rose, will locate the useless bivalve shell embedded *in situ*. *Cucurbitula cymbium* (Spengler) is another lamellibranch whose shell is even more effectively disguised. *Cucurbitula* creates for its burrow a pear-shaped encasement, moulded of sand and shelly matter, generally attached to another shell or piece of loose coral wherein to pursue undisturbed its placid philosophy of life—'*non omnia possumus omnes*'.

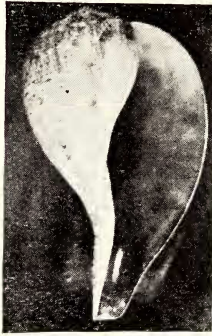
The months of May to August, when southerly winds prevail, provide us with an interesting series of juveniles in the earlier stages of shell development, i.e. at the commencement of the enlargement of their homes from the embryo or veliger stage. A powerful magnifying glass is essential in order to be able to note and appreciate the delicate beauty of these embryonic shells.

During the periods of storm, particularly in the autumn, Aviculids (Pteriidae) may be found still clinging to the branches of sea-fans which have been torn from the ocean bed, the shells varying in tone between yellow and red according to the colour of the particular Gorgoniid adopted for their life-long dwelling place. At these times some of the larger worn and broken shells which are washed ashore, such as *Ficus*, (Plate III, figs. 1 and 2) *Turritella*, etc., usually contain a family of the flat slipper limpet, *Crepidula walshii* Herrm., as many as a dozen often being crowded together into a wholly inadequate space, the neat circular baby shells clinging to the backs of their elders. The apices of the young shells show clearly the original spiral formation. It is advisable to boil these

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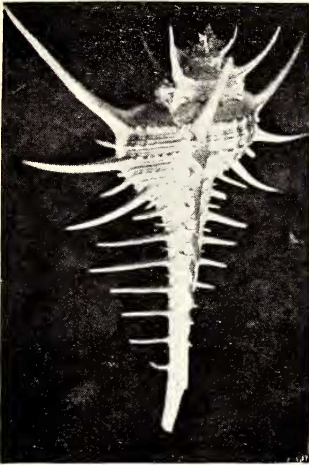
1. *Ficus graciis* (Sow.).



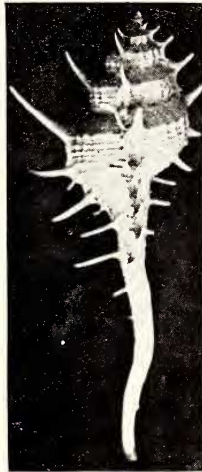
2. *F. ficus* (Lin.).



3. *Thais rudo'phi* Lam.



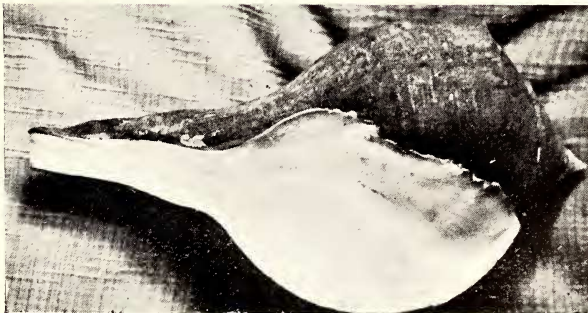
4. *Murex tribulus* Lin.



5. *M. traça* Rod.



6. *Rapana bulbosa* (Dill.).



7. *Xancus pyrum* (Lin.).
Height 9.2"; diameter 5.2".

MARINE SHELLS OF MADRAS.



1. *Conus textile* Lin.



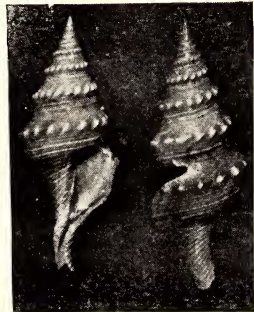
2. *C. betulinus* Lin.



3. *C. amadis* Lin.



4. *Turris indica* Rod.



5. *Turricula javana* (Lin.).



6. *Terebera commaculata* (Gmel.).



7. *T. duplicata* L.



8. *T. anilis* (Rod.).

out in order to avoid damaging the delicate edge of the inner plate. Colonies of *Crucibulum extincorium* auct., a close relative of *Crepidula* but of a limpet or cup-like shape and with the inner plate formed into a twisted poke or cone, are also often to be found adhering to the outer surface of dead or living shells. This possesses a clearly recurved apex which, however, is usually blunted or worn away. The shell varies greatly in shape according to its environment and not infrequently bears a coloured spiral decoration; it may also show a grooved or striated pattern impressed from the sculptured surface of the shell on which it has grown.

No record of the shells of the shore should omit mention of that sapphire harvest of the monsoon when the violet sea snails (*Ianthinidae*) are cast ashore, sometimes in prodigious numbers and still alive with their efficient floats attached, the delicate shells flung from the crests of the crashing waves and seldom suffering hurt because of their lightness and buoyancy. It requires several days of strong onshore winds to bring them from their ocean base and—this is important—one must be present when the miracle takes place; by next day the wind will have scattered the shells far and wide and scarcely a trace will remain. The two commoner species of *Ianthina* which visit Madras are of very distinctive forms. *I. roseola* Rv. is squat in shape, the aperture three-quarters square and the shell of a heavier and stronger structure than *I. iricolor* Rv., whose larger aperture extends to a point at the base and has an outer lip of cupid's bow shape. The latter is seldom seen, although in March, 1939, I witnessed a large influx of them in all stages of growth from 5 mm. up to 35 mm. in height, many of the larger size having closely arranged egg-pouches, of a pale mauve colour, hanging from the underside of the float.

In spite of their enforced migration, a highly efficient organization manifests itself by the presence of small jellyfishes (*Siphonophora*) which bear them company during the long voyage and upon which they feed. Many of these are also violet in tint or else a sea-green, examples being the thin circular *Porpita*, *Velella* with sail-like projection set diagonally across its raft, and the Portuguese man-o'-war (*Physalia*), all of which are invariably found on the shore in large numbers along with *Ianthina*. Young *Ianthina* sometimes drift to the shore in the early months of the year; even the tiniest of these, barely 2 mm. in height, is provided with its float several times the size of the shell. At the time of low tide the white, frothy appearance of the float bubbles and the brilliant blue shells sparkle in the sunshine on the smooth wet sand. At similar seasons, and apparently forming a unit of the flotilla, may also be found the acrobatic little *Glaucus marinus* (Du Pont)—but this is a shell-less mollusc and therefore outside the scope of these notes.

THE FISHING-NETS

It is worth while to be at hand when the great seine nets or *periyavalai*, taken a mile or so out to sea by Masula boat, are hauled in to shore. These frequently provide something new or desirable if one is quick enough, and lucky enough, not to miss

the prize as it slides elusively out of sight to be lost irremediably in the mass of soft palpitating bodies of fishes of all shapes and sizes, cuttles, medusae, crabs, and sea-snakes which are brought in with each haul. Incidentally, the collector would be well advised not to stand in the sea in the vicinity of the jellyfish which have to be cast out of the nets particularly during March and April. The slightest contact will set up a painful irritation and the affected part should immediately be rubbed down with sand and sea-water. A local cure is the application of tamarind paste. The villagers' name for jellyfish is *sori*, meaning itching. By means of these nets and particularly from a similar but smaller type of net known as *turi* which is used for ground trawling, being operated from two catamarans out to sea, many of our larger shells, usually in living condition, may be secured. I here mention some of these without adopting any particular order.

Harpa conoidalis Lam. is the sole representative of the family Harpidae. The shell is sturdy, richly decorated, and gloriously polished within. The inhabitant, at any effort to draw it forth, detaches the hinder and deeper coloured portion of its foot, which is left in one's hand in a most disconcerting way, much as the gecko with its tail. This solid fleshy attachment is fitted into a groove running along the posterior edge of the foot proper and comes away with very little pressure, leaving a clean undamaged socket which reminds one of the spring-back binding of a certain type of loose-leaf album. The amputation can be, and is, performed without adventitious aid, as occurred with a fully grown specimen which was being kept under observation in a bowl of sea-water; this individual climbed over the edge of the bowl and tumbled out leaving the lobular appendage behind. On another occasion this part detached itself and fell to the ground when a specimen was being transferred from one bucket to another, the shell being held mouth downwards and without any contact with the inmate. My largest specimen of this shell, collected at Madras, measures 95 mm. in height and 68 mm. in diameter.

The Conidae, with narrow operculum which is not always easy to locate, provide at least half-a-dozen species. *C. figulinus* L. is the common form with thick brown shell, but *Conus amadis* L. (Plate IV, fig. 3) is of outstanding beauty both in colour and brilliance of polish, varying considerably in design and fairly plentiful. *C. betulinus* L., (Plate IV, fig. 2) with thick periostracum and decorated with rows of dark brown spots, is of massive proportions and grows to above 4 inches in height, with a circumference of twice that measurement. My largest specimen measures 110 mm. in height.

The Ficidae or fig-shells number three species, all of them with delicately graved reticulate pattern and thin outer lip whose fragile edge, in the growing shell, requires the greatest care in cleaning to avoid chipping.

The Muricidae are well represented, many being provided with formidable defence works such as *Murex virgineus* (Röding), with mouth edged with coral pink and the spiny *M. tribulus* L. (Plate III, fig. 4). Some *tribulus* develop a distinctive

sculpture, the main feature of which is the number of transverse ridges between each of the major spines which varies from five to eight instead of the usual three. In addition the tubercles on the body-whorls of the former are closer set and more numerous; until young specimens of the former type have been found it must be assumed that the variation is merely a late development of the same species. *M. trapa* Röding (Plate III, fig. 5), a third variety of the type found at Madras is distinguished by its elongate spire but, particularly, by a prominent denticle in the anterior portion of the outer lip which can be traced back in the varices to the earliest whorls of the shell. The delicate *Murex pinnatus* Swainson, with feathery fin-like varices, is also worthy of special mention.

Cymatiidae, of which some half-a-dozen species may be secured, are of strangely irregular shape and furnished with fringes of strong bristle-like hairs along the crests of the varices.

The Tonnidæ are represented by four species of which *Tonna dolium* (L.)=*maculata* (Lam.) comes ashore in large numbers. The protoconch is a tiny, smooth, amber-coloured spiral globe and bears no resemblance to the developed shell, but will be readily recognized by an examination of the apex of a mature specimen. A series of this shell showing the different stages of growth, the thickening and strengthening of the shell and the development and final fading away of the colour pattern as the supply of pigment becomes inadequate for the adornment of the expanded surface, can easily be formed. This method of collecting might, indeed, be applied to many of the spiral shells to add an instructive interest to the collection.

Amongst the Pectinidae is the beautiful *Amusium pleuronectes* (L.), known as the 'sun and moon shell', with the left or upper valve of livid hue and the other a dead white. This lamellibranch gets caught up in the nets a few miles south of Elliot's Beach, off Tiruavamoor, the adults arriving early in February, apparently for spawning as the spat and growing shells are in evidence from early March until June. Full-grown specimens measure up to 83 mm. both in length and height. *Amusium*, in common with other members of the Pectinidae, is active in its movements and, if placed in a large basin of sea-water may be seen to dart about with an amazing quickness of action. The animal is provided with a hundred or so eyes of different sizes, round and staring like those of a doll, which are placed at odd intervals among the waving filaments which fringe the edge of the upper mantle just inside the rim of the shell. I have counted up to 106 such eyes in one individual. *P. pyxidatus* (Born) has about 30 and *P. tranquebaricus* Gm. upwards of 50 eyes fringing both mantles to the auricle extremities.

Madras can claim about forty species of the family Veneridae among which three *Paphia*, commonly brought in from the deeper sea during the latter months of the year, deserve special mention by reason of their colouring and brilliant sheen, namely *P. alapapilionis* Röding (85 mm.), *P. textile* (Gm.) (66 mm.), and *P. gallus* (Gm.), also known as *P. malabarica* (57 mm.); the

measurements given in brackets are the lengths of the largest specimens so far collected by the writer. Several specimens of *P. undulata* (Born), distinguishable from *textile* by well marked, irregular, concentric ridges, have been found recently after a lapse of many years. Similar occurrences of the intermittent appearance of a particular species, after an apparent interval of years, are evident from time to time; a further example may be cited this year (1940) in the case of *Xenophora solaris* (L.) (Plate II, fig. 3), sixteen live specimens having been brought up in the catamaran drag nets during the month of July although no specimens had been recorded during the past five years.

Maclridae, too, are plentiful, amongst which *Maclra turgida* Gm., swollen out as its name implies and with umboes violet-tinged, is notable for its size, as is also the gaping *Cultellus maximus* (Gm.) (Plate I, fig. 4), of the Solenidac, which exceeds 5 inches in length.

Volva sowerbyana (Weink.), a small relative of the *Cypraeidae*, is rarely taken in live condition. The mantle fringe is dotted with bright spots of deep orange colour and the shell itself has an attractive sheen which, however, soon wears off.

Hydatina velum (Gm.), light as a bubble and measuring up to 46 mm. in height and 4 inches in circumference, is brought to shore in fair numbers about July and again towards the end of the year. To see the animal fully exerted and expanded, with frills and flounces most attractively fringed with purple, fills one with amazement that so much can come out of so little. To tuck itself in again requires delicate adjustment and takes time.

The true *Cussis* is not known at Madras but there are four species of the genus *Phalium*. These have brightly decorated shells, particularly *Phalium areola* (L.). *P. glaucum* (L.) has also a very handsome shell which grows to 4 inches or more in height. The animal is beautifully coloured in orange, brown, etc., the mantle being bordered with a brown edge. This is capable of expelling a purple fluid which will soon discolour a bucket of water.

Of the Strombidae, which are well represented in the Gulf of Manaar, four species have found their way as far north as Madras; *Strombus succinctus* L., whose shells, with expanding outer lip and measuring about 2 inches in height, are very occasionally brought in. These are invariably tenanted by hermit crabs, no living specimen having so far been taken. The young shells up to $\frac{3}{4}$ in. are not infrequently found on the shore. Madras's other Strombs are *S. siboldii* Sow., (?) *S. vittatus* L., and *Rimella cancellata* (Lam.), a most attractive little shell of about 1 inch.

A few miles south is located the local chank bed, to judge by the number of *Nancus pyrum* (L.) (Plate III, fig. 7), brought in. These are of the Tanjore tribe, fully turbinata and with flesh-tone colouring within. A large specimen, taken in a fisherman's net off Warikuppam, the village immediately south of Elliot's Beach, measures $9\frac{1}{4}$ inches in height and $15\frac{1}{2}$ inches in circumference, and weighs $2\frac{1}{2}$ lbs. This is a truly handsome shell although not so highly prized for the bangle industry as the purer white and more spindle-shaped *X. rapa* (Lam.) of Tuticorin. Young shells of both

these species are as a rule brightly decorated with closely set rows of brown spots. The egg-case of this mollusc is occasionally washed up during the early part of the year, in shape reminiscent of a goat's horn, with numerous segmental divisions stuffed with embryonic shells. The nipple-like protoconch persists in the full-grown shell as also in *Tudicla spirillus* (L.), of the same family, which is also found in this locality.

Few collectors can boast the possession of a sinistral chank. This well-known variety commands fancy prices partly on account of its scarcity but chiefly because it possesses a religious significance in Hinduism and Buddhism, which ensures a keen demand locally at all times. At long intervals one of these desiderata comes on to the market, the price realized for a medium-sized specimen being usually about Rs. 500 to Rs. 800, although much higher sums have been paid. Unfortunately there is no record of the number of sinistral chanks taken off the east coast of India, the Tanjore Chank Fishing-rights having been leased out by Government to contractors except for two or three seasons only when it was worked departmentally. During these years, out of a total catch of 57,324 shells, there is no record of a sinistral chank having been taken. The Tinnevely Chank Fishery at Tuticorin has remained under strict Government control for many years. The records in this Department show that only two sinistral, or *valampuri* (meaning 'right twist') chanks were taken during the twenty-four years from 1914—one in 1930 and one in 1937—out of a total annual catch which, in recent years, has averaged between 300,000 and 400,000 shells. The fortunate diver who brings in a specimen receives a reward of one thousand times the price of a normal shell, which, at the present rate of one anna per shell, would amount to Rs. 62-8 as. From what I can gather it would appear that the sinistral variety of *X. rapa* of the Gulf of Manaar is much scarcer than that of *X. pyrum*, the Tanjore or Madras species.

The only other freak sinistral shell that I have seen from South Indian waters was a specimen of *Marginella angustata* Sowerby. Two species of *Triphora* in which the sinistral condition is normal may be found at Madras.

Many minor freak formations may be found such as in *Murex tribulus* L. (Plate III, fig. 4), whose normally straight canal is sometimes sinuous or twisted, and *Natica didyma* (Röding) (Plate II, fig. 5) with scalariform whorls. *Thais bufo* (Lam.) develops a remarkable thickening of the columellar lip which may even engulf the apex of the shell and was made a separate species by Lamarck under the name *callosa*. In another category are the malformations due, for the most part, to some early fracture and subsequent repair which has interrupted the orderly growth of the shell or disturbed the normal position of the varices or other processes, such as occur in *Murex* and *Volva*. From a similar cause damage to the mantle may affect the supply of pigment resulting in the colour-pattern of the shell changing or even vanishing altogether. I have examples of these in *Natica alapa-pilionis* (Röding) and *Tonna dolium* (L.). Albinism is of frequent occurrence amongst some of the brightly coloured bivalves such as Tellinidae as well as in

certain gastropods, for example *Drillia crenularis* (Lam.) and *Turricula tornata* (Dillwyn). I have also seen a striking example in *Conus amadis* Gm., which normally boasts a resplendent coat of brown and gold.

Our only Volute is *Cymbium*, the melon-shell, which grows to nearly a foot in height and twice this measurement in circumference. The animal wears a handsome mantle decorated with yellow and dark-brown stripes, depicted on the shell in the earlier stages of growth, while the interior of the shell has a beautiful satiny sheen. These are fairly plentiful, particularly towards the end of the year.

The best collecting period from the nets is from December to February when the mature molluscs apparently return each year to their spawning grounds in the shallower depths reached by the smaller trawling nets, say, perhaps, of 10 to 15 fathoms.

DREDGING.

To explore with a dredge the sea bed of Royapuram Bay, and such depths as can be dragged by hand from a small boat yields a rich harvest of various dwellers in mud and sand.

With the first haul one is almost certain to see *Babylonia spirata* (L.), a powerfully built mollusc which, when dropped into the Kilner jar, immediately begins to throw its weight about in its endeavour to force an escape, much to the discomfiture of its fellow-captives. The aperture of the shell is usually of a highly glazed porcellanous white but a variation also exists in which the mouth and columella area are coloured a fulvous yellow. The two varieties are very distinct. Furthermore, the shell normally has a deeply excavated umbilical opening but specimens are not uncommon where the lower part of the columellar lip has folded backwards and spread over this opening until the umbilicus is completely obscured. The mature shell is generally about 2 inches in height but specimens are found exceeding $2\frac{1}{2}$ inches. *B. zeylanica* (Brug.), a scarcer member of the family, is remarkable for the bright violet colouring within the umbilical opening of the shell and the two richly coloured red-brown bands which decorate the upper side of the leaf-shaped foot of the animal.

Several species of *Mitra*, including *Vexillum*, and of *Cancellaria* will be found as well as the very striking staircase-shell, *Architectonica*, with its variations in design, its brightly coloured decorations and peculiar pegged operculum.

Volema pugilina (Born), one of the largest shells of the coast, is obtainable here and, at the other extreme as regards size, *Phacoides macassari* (Prashad), a tiny spherical bivalve of extraordinarily deep sculpture, which barely fills the 5 millimeter gauge in any direction.

The Conidae and Terebridae, of the tribe Toxoglossa, whose members are provided with a poison-gland, occupy an important place amongst the Madras mollusca. In addition to the Coninae, whose sole genus *Conus* (Plate IV, figs. 1, 2, and 3) we have already noted, the Conidae family is divided into the sub-families

Brachytominae, Cytharinae, and Turrinae, the shells having a sinus or slit at the upper end of the labrum which at one time earned for them the descriptive group-name of Pleurotomatidae. Madras can claim over fifty species of these 'silt-lips', many of them obtainable by dredge.

The local Terebridae, numbering some eighteen species (Plate IV, figs. 6, 7, and 8), display considerable diversity in design and colour pattern. In size they vary from the $\frac{1}{2}$ in. *Terebra tenera* Hinds, to a height of close upon 5 inches in *T. commaculata* (Gm.) (Plate IV, fig. 6). Many of these are fairly plentiful at a depth of from 15 to 20 fathoms, both out from the harbour and farther south. *T. triseriata* Gray, remarkable alike for its attenuated form and delicate sculpture, is one of the scarcest of the Madras shells whereas *T. eximia* Dh., reputedly a shell of some rarity, apparently pays seasonal visits to Madras waters a few miles south of Elliot's Beach, the empty shells, in fairly fresh condition, but generally with a hermit crab in possession, being not infrequently brought up in the fishing-nets during the north-east monsoon season. There are two varieties of *T. eximia* with three and four narrow bands respectively between the main spiral bands. No living specimen has yet been taken locally and my efforts to locate their place of settlement have resulted only in the capture of a dead specimen obtained at a depth of 15 fathoms. The shells measure up to slightly over $2\frac{1}{2}$ inches in height.

Marginella ventricosa Fischer with deep olive-green shell which soon fades to a dove grey on exposure to the air, is a gem which should be preserved as long as possible in the home aquarium in order to mark the bejewelled decoration of mantle and tentacles. *M. angustata* Sowerby, of brilliant polish, is plentiful in all stages of growth.

Philine is an interesting creature, to outward appearance a lump of white, rather solid, jelly. Careful dissection is necessary here in order to expose, without fracture, the gossamer-thin shell within and the gizzard plates which are so well fitted for crunching the shells of smaller mollusca for food. It may happen that a tiny shell is actually in place for cracking at the moment of capture. *Sinum*, a relative of *Natica*, also has the shell hidden within the flesh and likewise requires delicate handling. *Ancilla* is unable to retire wholly within its smooth ivory-like shell but in this respect cannot be compared with the internal shells of *Philine* and *Sinum*.

Arcidae are in abundance and in varied forms which include the hirsute *Barbatia*, the strange twisted *Trisidos tortuosa* L. and, in the mud deposit off the East Quay, at a depth of 6 fathoms, *Cucullaea concamera* (Brug.), which is provided with a cup-like compartment in each valve for the attachment of the anterior adductor muscle. *Glycymeris*, a relative of *Arca*, is also plentiful.

The nut-shell (*Nucula*) with nacreous interior and the tiny *Nuculana*, whose shells are never to be found on the shore in fresh condition, are obtainable in Royapuram Bay in 6 to 8 fathoms. Two varieties of *Nucula* are common, one with smooth rims and the other with the interior of the margins finely serrated. *Aloidis*, better known by its synonym *Corbula*, with misfit valve, is another of

the smaller lamellibranchs, several species of which will be taken from the same fishing-ground.

Tellinidae are well represented, also cockles [*Cardium* (Plate I, fig. 1) and *Cardita*], the razor-fish (*Ensis*), *Cultellus* (Plate I, fig. 4), and *Pandora*. *Cardium asiaticum* Brug., odd valves of which are common on the beach, in live condition has the radiating ridges set with sharp-pointed spines and delicate laminae which are absent in beach specimens.

Among the sea-urchins there are two species, *Temnopleurus toreamaticus* and *Salmacis rubricincta* (?), which play host respectively to species of *Eulima* and *Stylifer*, whose minute shells may be found attached between the spines. The Holothurians or sea-cucumbers should not be thrown back without inspection. If the long-fingered starfish, *Linckia*, should make its appearance it should be searched carefully for a small Capulid of the genus *Thyca*, though I must confess that it has so far eluded me.

THE HARBOUR.

Residents of Madras may be surprised to learn that upwards of fifty different species live in the harbour, some preferring a site to seaward although battered constantly by the waves, others choosing the tranquil waters within.

The harbour floor consists of a slimy, soft mud which is practically devoid of mollusc life with the exception of very occasional specimens of *Pandora*, *Paphia*, and *Cancellaria*, which can be obtained under pleasanter conditions out to sea. The large buoys or ships' moorings in the centre of the harbour are also disappointing, being overcrowded by *Mytilus viridis* L. to the exclusion of aught else. The collector is recommended to steer his boat to the inner quay on the northern side where good 'bags' can be secured amongst the submerged agglomeration of seaweeds, sponges, hydroids, and other sea-growths rooted to the wooden piles. The Lamellibranchia are almost exclusively of the fixed type, that is either cemented to the piles or to each other, or anchored by a byssus. Amongst the former are the massive *Chama* and *Spondylus* whose rough surfaces often bear strong outgrowing spines, the interiors being flushed with purple-rose. Of the byssus-forming mollusca a fairly representative collection can be formed, amongst which will be counted three or four species of Arcidae, of which *Arca lateralis* Rv. develops an interior plate or shelf-like septum although not so pronounced as in the case of *Cucullaea concamera*. Others are the oysters and mussels including the allied forms *Anomia*, *Septifer*, *Malleus*, and *Isogomou*, the last with a hinge reminiscent of a 'zip' fastener. *Lima lima* (L.), whose fringe of red and white filaments in constant motion is fascinating to watch, is provided with a beautiful pure white laminated shell.

The Gastropoda are about equal to the bivalves in numbers. *Euchelus asper* (Gm.) with rounded whorls, a Trochid of solid mother-o'-pearl, flourishes in large numbers throughout the year along with the flattened and sharply ridged sub-variety *tricarinata*. *Gyrineum natator* (Röding) (Plate II, fig. 9), a neatly sculptured

Cymatiid shell attaining a height of at least 2 inches, will also be found in abundance, particularly during the early months of the year. Species of *Engina*, *Pyrene*, *Drupa*, and *Thais* (Plate III, fig. 3) also live here.

Of the dozen species of cowry known to Madras, three at least make their homes here, viz. *Cypraea arabica* L., *C. pallida* Gray, and *C. ocellata* L. The last-named, decorated with brightly coloured ocelli, is a brilliant shell which it would be difficult to recognize in beach-worn specimens. Others attracted to this rich pasturage include the keyhole limpet, *Diodora lima* (Sow.) and the scarcer *Amalthea tricarinata* (Gm.). The latter challenges close scrutiny, being almost indistinguishable in its brown jacket, clinging limpet-like to a pearl oyster or gigantic mussel.

During the cold-weather months of 1938-9, large numbers of the small limpet-shaped brachiopod *Discinisca indica* Dall appeared. At low tide in the same area a Chiton should be looked for just above the sea level. This belongs to the genus *Acanthochitona* and may exceed 1 inch in length. It can be recognized by the tufts of strong bristles (eighteen in number) which decorate the margin or girdle. Numerous specimens of *Cypraea arabica*, already found on the piles, some reaching a basal measurement of 3 inches, and an occasional immature shell will also be found at low water, lurking in the deep fissures in the north wall which is also the home of *Mitra caeligena* Rv.

Higher up on the harbour wall, near and above the sea mark, are to be found *Littorina undulata* (L.), in vast quantities, of varied pattern and colour, and the local *Planaxis sulcatus* (Born) which is smaller than the Pamban and Tuticorin shell. A *Siphonaria*, that strange pulmonate of limpet form, will also be found here and the true limpet, *Patella (Cellana)*.

The limpets, of which there are two or, possibly, three species, and several species of *Thais* thrive on the rocks outside the harbour walls where the boisterous and unexpected wave rejoices to catch the unwary mortal. Small chitons, *Plaxiphora indica* Thiele, may be taken clinging to the barnacle-roughened walls or lying closely hidden under the sea moss which covers the submerged concrete blocks of the breakwaters. This moss also provides cover for the dainty little *Pyrene terpsichore* (Sow.). *Venerupis macrophylla* Dh. should be looked for in chinks in the rocks where it lies securely wedged, although at times also found among the algae.

An opportunity should be watched for to explore the pools at the base of the blocks of concrete piled up in the fork at the northern end of the East Quay. Suitable conditions of low tide, combined with a westerly wind to check the incoming swell, will be met with during July. This exclusive site possesses a distinctive fauna which includes several mollusca not to be found elsewhere at Madras. Pride of place must be given to a large colony of *Turbo argyrostoma* L. clinging to the outer rocks at or just below sea-level; these are in such numbers that a handful of three or four at a time can be gathered. *Nerita albicilla* L. and *Nerita chamaeleon* L. will be noticed higher up on the rocks. Nerites have the nocturnal wandering habits of land-snails and are best collected